Background: Carbapenem-resistant Enterobacteriaceae (CRE) are associated with mortality and morbidity. Cleaning of high-touch surfaces (HTS) in the patient environment is often suboptimal. The aim of this study was to assess the efficacy of UV-C light to reduce CRE in a patient room, and to ascertain if there was a difference in CRE elimination based on organism (K. pneumoniae vs. E. coli vs. E. cloacae).

Methods: This study was performed in an empty patient room of The Johns Hopkins Hospital in September 2015. A template of a single Rock plate (Becton Dickinson) was drawn on Formica® swatches. Each template was inoculated with 0.5 x 10^6 (10^6) CFU of K. pneumoniae (10% concentration) of a single CRE. The inoculated swatches were attached to a minimum of 17 HTS (e.g. call bell, bedrails) in the patient room and bathroom. The UV-C Clorox Healthcare™ Optimum UV™, which emits UV-A via maximum output mercury lamps, was activated for 15 minutes. A Rock plate was then pressed onto each swatch. Plates were incubated at 37°C for 24 hours. Colony forming units (CFUs) were counted and growth of CRE identified for each CRE organism. Negative controls, inoculated swatches placed in a box to prevent exposure to UV-A were used for all cycles. The images below demonstrate the placement of the inoculated swatches on the High Touch Surfaces.

Results: There were 133 HTS sampled; 34 with E. coli, 47 K. pneumoniae, 52 E. cloacae. All negative control swatches grew organism (K. pneumoniae, E. coli and E. cloacae) from HTS in a patient room and bathroom. The short cycle time made this a realistic option for daily patient room disinfection. Although there was a trend in the lower efficacy of this technology to decrease patient infections and transmission of pathogens in the healthcare setting.

Conclusions: This study shows that UV light is highly effective in killing CRE (K. pneumoniae, E. coli and E. cloacae) from HTS in a patient room and bathroom in 15 minutes. We found complete reduction of CRE from 25 different HTS in the patient room and bathrooms, including the IV pump, vital monitor, call box, keyboard and toilet seat. The only 2 sites where we found growth of CRE (E. cloacae) post UV was one shower curtain and one bed rail. The shower curtain swatch, which grew NTNC CRE, was between two curtain folds and we hypothesize not exposed to UV. The privacy curtain in the patient room which was not folded had complete reduction of CRE, highlighting the importance of setting the room to maximize surface exposure to UV; such as straightening curtains. We found no difference in reduction based on organism. There has been recent suggestion in the literature that K. pneumoniae may persist in the near patient environment longer than E. coli or other gram negatives.

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Table: CRE disinfection of HTS post UV-C light.

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